

## Selenide retention by mackinawite

N. Finck<sup>a,\*</sup>; K. Dardenne<sup>a</sup>; D. Bosbach<sup>b</sup>; H. Geckeis<sup>a</sup>

<sup>a</sup>Institute for Nuclear Waste Disposal (INE) – Karlsruhe Institute of Technology (KIT) , P.O. Box 3640, 76021 Karlsruhe, Germany (\*Nicolas.finck@kit.edu). <sup>b</sup>Institute for Energy Research – Safety Research and Reactor Technology (IEF-6), Research Centre Jülich, 52425 Jülich, Germany.

The isotope <sup>79</sup>Se may be of great concern with regard to the safe disposal of nuclear wastes in deep geological repositories. This fission product produced in nuclear power plants has a long half-life ( $4.8 \times 10^5$  yrs (Magill, 2006)) and is potentially mobile in the geosphere. The oxidation state of Se controls its mobility: Se(VI) and Se(IV) are highly mobile whereas Se(0) and Se(-II) form low soluble solids. The mobility of this trace pollutant can be greatly reduced by interacting with the various barriers of the repository.

The retention of the oxidized species by mineral phases is documented in the literature, but only very scarce studies report on the selenide (Se(-II)) retention. In the present work (Finck, 2012), the selenide retention by coprecipitation with and by adsorption on mackinawite (FeS) was investigated. XRD and SEM analyses of the samples revealed no significant influence on the FeS precipitate morphology and structure. Molecular scale information of the coprecipitation and of the adsorption sample was obtained by a multi-edge XAS investigation. All elements constitutive of the coprecipitation sample (S, Fe and Se) are in a low ionic oxidation state and EXAFS data point to Se located in a FeS-like sulfide environment. In the adsorption sample, part of Se is located in an environment similar to that in the coprecipitation sample. This result is explained by a dynamical dissolution – recrystallization mechanism of the highly reactive mackinawite. This is the first experimental study to report on selenide incorporation in iron monosulfide by a multi-edge XAS approach.

### References

- Finck, N.; Dardenne, K.; Bosbach, D.; Geckeis, H. (2012) *Environ. Sci. Technol.* 46, 10004-10011.
- Magill, J.; Pfennig, G.; Galy, J. (2006) *Chart of the Nuclides*, 7<sup>th</sup> ed., European Commission, DG Joint Research Centre, Institute for Transuranium Elements, Karlsruhe, Germany.